

November 6, 1996

MEMORANDUM TO: David B. Matthews, Chief  
Generic Issues and Environmental  
Projects Branch  
Division of Reactor Program Management  
Office of Nuclear Reactor Regulation

FROM: Egan Y. Wang, Reactor System Engineer Original Signed By:  
Generic Issues and Environmental  
Projects Branch  
Division of Reactor Program Management  
Office of Nuclear Reactor Regulation

SUBJECT: MEETING SUMMARY OF NOVEMBER 4, 1996, REGARDING THE  
"REALISTIC LOCA ECCS EVALUATION MODEL FOR PWR LARGE BREAK  
LOCA ANALYSIS"

On November 4, 1996, representatives of Siemens Power Corporation (SPC) met with representatives of the Nuclear Regulatory Commission (NRC). The purpose of this meeting was to provide an opportunity for SPC representatives to review and discuss the "Realistic LOCA ECCS Evaluation Model For PWR Large Break LOCA Analysis" code issues. SPC representatives provided an introduction and a brief description on current activities with regard to the codes. Most of the meeting involved presentation of proprietary information. Attachment 1 provides a list of meeting attendees. Attachment 2 is the non-proprietary version of the presentation material.

Attachments: As stated

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Corporation Dated November 6, 1996

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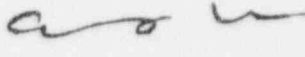
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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

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cc:

Mr. H. D. Curet, Manager  
Product Licensing  
Siemens Power Corporation  
2101 Horn Rapids Road  
P. O. Box 130  
Richland, WA 99352-0130

NRC/SIEMENS POWER CORPORATION MEETING  
ON MIXED OXIDE FUEL  
LIST OF ATTENDEES  
Oct 23, 1996

NAME

ORGANIZATION

Burns, J. P.	WPPSS
Heiks, R. L.	Siemens
Garner, N. L.	Siemens
Garber, D. E.	Siemens
Copeland, R.	Siemens
Collins, T. E.	NRC/NRR
Kavanagh, K.	NRC/NRR
Richines, H.	NRC/NRR
Wang, Egan	NRC/NRR

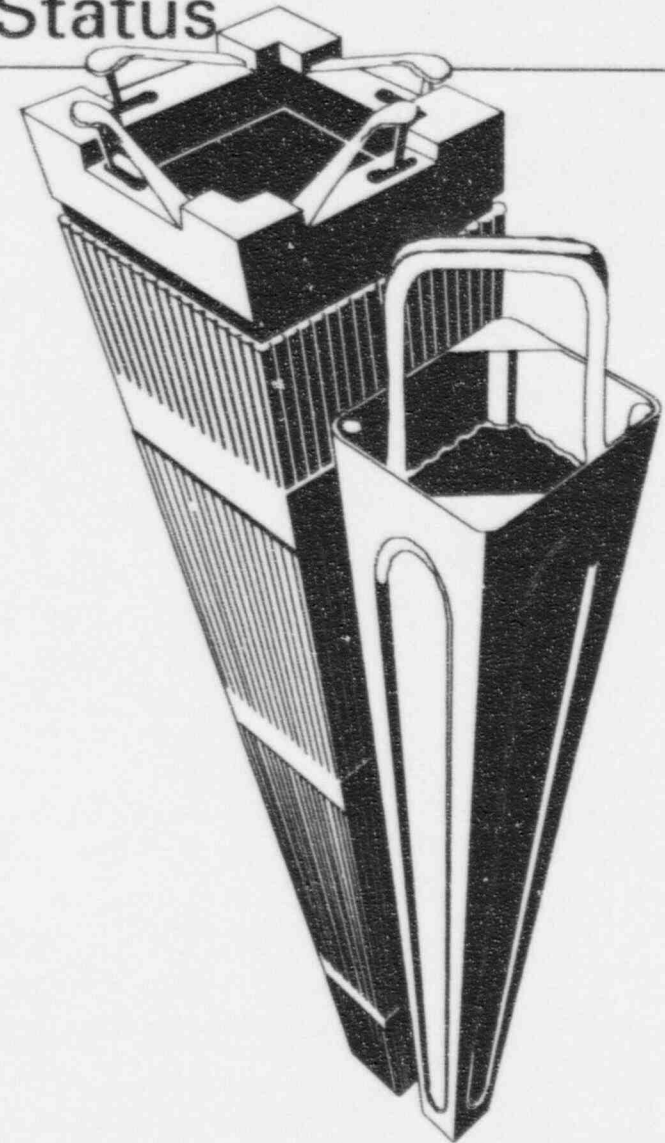
# Overview of Realistic PWR Large Break LOCA Methodology and NRC Review Status

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Presented by:

H. D. Curet and S. E. Jensen

Siemens Power Corporation - Nuclear Division



## Introduction

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- Purpose - Overview of submitted methodology and supporting documentation
- Objective - Demonstrate sufficient methodology documentation to justify reinitiating the review

## Key Events

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- RODEX3, April 1991 submittal approved in February 1996
- Realistic PWR LBLOCA Code and Methodology submitted October 1992 and December 1992, respectively
- Westinghouse "BE Model" submitted August 1992
- SPC Uncertainties Analyses submitted July 1993
- ITS discontinued review of SPC Methodology in September 1994
- SPC anticipated NRR and contractor to reinitiate review in June 1996
- Westinghouse "BE Model" approved June 1996
- Received copy of ITS close out report September 1996
- Lessons learned from Westinghouse review August 1992 to June 1996 to be applied to future "BE Model" reviews
- Meeting with NRR on November 1996 to discuss lessons learned to be applied to SPC Realistic Model



## Background

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- In 1988 USNRC revised the LOCA Emergency Core Cooling System Rule to allow realistic LOCA evaluation models in place of prescribed conservative models
  - Uncertainties in realistic evaluation models to be quantified
  - High probability that 10 CFR 50.46 criteria are not exceeded including uncertainties
- Basis for rule change is extensive research performed after 1975 rule as documented in "Compendium of ECCS Research"
- NRC issued Regulatory Guide 1.157 providing guidance for best estimate LOCA analysis
- NRC developed code scaling, applicability, and uncertainty (CSAU) evaluation methodology

## Status of Realistic LOCA Submittal

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- Realistic LOCA submittal consists of 14 topical reports which have been submitted for NRC review as follows:
  - ANF-90-145(P), Vols. 1&2, RODEX3 Fuel Rod Model, submitted April 1991
  - EMF-92-139(P), Vol. 3, Assessments, submitted September 1992
  - EMF-92-139(P), Vol. 2, S-RELAP5 Code, submitted October 1992
  - EMF-92-139(P), Vol. 1, Methodology Description, submitted December 1992
  - EMF-92-139(P), Vol. 3, Supplements 1-7, Assessment Calculation, submitted July 1993
  - EMF-92-139(P), Vol. 4, Uncertainties, submitted July 1993
  - EMF-92-139(P), Vol. 5, 4-Loop PWR Uncertainties, Submitted September 1995
- Final planned methodology report submitted July 1993

## General Methodology

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- Select codes based on capabilities
- Specify LBLOCA scenario, identify, and rank phenomena (PIRT)
- Establish assessment matrix
- Define system and experiment nodalization
- Perform assessments, determine accuracy and bias, and effects of scale
- Perform NPP calculation
- Determine uncertainty and biases
- Total uncertainty to calculate LBLOCA scenario in specific NPP

## Codes for Realistic LOCA

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- RODEX3 - Fuel rod thermal mechanical response
- S-RELAP5 - System thermal hydraulic response (steady & transient)
- ICECON - Containment backpressure
- GSUAM - Generic statistical uncertainties analysis methodology



## Benchmarks (cont'd)

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- SPC assessments of S-RELAP5 against integral test experiments:
  - [ ]
  - [ ]
  - [ ]
  - [ ]
  - [ ]
  - [ ]
- Assessments selected to encompass entire range of LBLELOCA blowdown, refill, and reflood phenomena from facilities of varying scale
- Example calculations of Westinghouse 3-loop and 4-loop PWRs are provided

## Uncertainties Methodology

**Methodology:**

## Background

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## Uncertainties Methodology

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### Parameters treated deterministically

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## Uncertainties Methodology

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Parameters included in experimental design

[ ]

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## Uncertainties Methodology

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# Uncertainties Methodology

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## Additional uncertainties

- Plant uncertainties

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- [ ]
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- [ ]
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## Uncertainties Methodology

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Uncertainties combined using GSUAM ([ ] trials)

Monte Carlo PCT Calculation Results  
3-Loop Westinghouse PWR

[

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## Uncertainties Methodology

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Uncertainties combined using GSUAM ([ ] trials)

Monte Carlo PCT Calculation Results  
4-Loop Westinghouse PWR

[

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## Summary and Conclusions

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- SPC developed Realistic PWR LBLOCA evaluation model following CSAU stepwise approach
- [ ]
- Code applicability and scaling effects evaluated by numerous assessments against experimental data
- Methodology uncertainties were identified, quantified, and combined using GSUAM
- [ ]
- [ ]
- Methodology submitted to NRC for review

## Summary

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- SPC submitted PWR Realistic LBLOCA Methodology to update technology
- [ ]
- [ ]
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